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Commentary

Penetration of Asbestos through the Digestive Wall in Rats*

by R. D. Pontefract†

Distribution studies on asbestos fibers administered to rats were performed with the electron microscope and were supplemented with studies involving use of tritiated and neutron-activated asbestos.

Chrysotile filbers were injected into the stomach of rats, and 2–4 days later various tissues were solubilized and their fiber content studied. Fibers were isolated from the blood, spleen, omentum, and brain of the treated rats. Highest levels of orally administered fibers decreased within 24 hr in the blood, lung, and spleen; the count remained high in tissues such as the omentum and brain.

Based on Westlake's earlier work *(1)* and some other work by Godwin and Jagatic *(2)*, we investigated the possibility of asbestos fibers passing through the wall of the digestive tract and then being disseminated to various organs. The asbestos was introduced into the gastrointestinal tract by opening the abdomen under anesthesia and injecting the fibers by needle directly into the stomach. The rats were killed 2-4 days later, and blood and tissues were analyzed for asbestos. Chrysotile was used, with most of the fibers in the range 0.2–2.0μm.

The tissues were first solubilized with soluene, then the fibers were centrifuged down, washed with methanol, and ashed. The residue was taken up in a known volume of distilled and filtered water and examined under the electron microscope.

Two groups of rats were used. Group 1 was given 9.4×10^9 fibers and killed 2 days later; group 2 was given 94×10^9 fibers and killed 4 days later. The counts obtained in the various organs are given in Table 1.

The lower concentrations found in the blood of the second group, in spite of their receiving ten times as big a dose, indicates a fairly rapid clearing of the blood, as would be expected.

We tried tritiating asbestos and feeding it orally to rats, but the tritium leached out of the fibers and increased the background levels. To

Table 1. Asbestos fibers in various tissues.

	Fibers/g tissue (mean of 5-rats × 10^6) ± S.D.		
	Controls	Group 1	Group 2
Blood	0.00	4.65 ± 1.02 [a]	1.19 ± 0.77
Spleen	2.33 ± 0.67	4.11 ± 0.49	3.45 ± 1.20
Omentum	2.46 ± 0.46	2.74 ± 0.87	18.25 ± 7.79
Heart	2.09 ± 0.41	—	2.28 ± 0.40
Brain	0.05 ± 0.02	0.31 ± 0.19 [b]	0.29 ± 0.11 [c]
Lungs	1.06 ± 0.26	1.80 ± 0.54	1.74 ± 0.26

[a] $P<0.01$.

[b] 4 rats only.

[c] $P<0.05$.

*Editor's extract from transcript of presentation.

†Food Research Laboratories, Canadian Department of National Health and Welfare, Ottawa, Ontario, Canada.

check the distribution of blood-borne asbestos particles, we injected them intravenously and obtained rapid rises in the lung after an hour or so, and also in the liver and kidney. After 24 hr the lung count dropped greatly, indicating its clearance power, but the spleen count did not drop and remained high after 24 hr. In the brain and some other organs the count also stayed up, and we found fibers in the brain on electron microscopy.

In autopsy material from persons who had died from natural causes we found asbestos fibers in the brain and also in the omentum. We have not done any investigations on asbestos fibers in the lymphatic system.

It is possible that the stomach wall in our injection experiments was contaminated during withdrawal of the needle, but we do not think that the amount could account for the increases that we have reported. In other experiments we introduced large glass fibers through a tube directly into the stomach and found that these passed through the wall. If large glass fibers can penetrate the wall, surely small asbestos fibers can.

REFERENCES

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